SECTION [15141] [02516]

DISINFECTION OF POTABLE WATER PIPING

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LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection requirements for the following new, repaired or modified systems:

1. Potable water distribution piping [on Project site and within buildings].

2. [Fire protection piping below grade to base of riser.]

B. Dechlorination procedures for chlorinated water discharges.

C. Discharge requirements (point of discharge and chlorine concentration).

D. Note: Disinfection of non-potable water piping and fire protection piping downstream of alarm check valve or fire line backflow preventer is not required.

1.2 LANL PERFORMED WORK

A. Water quality testing: LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. LANL will approve use of disinfected piping when test results demonstrate compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D.

1.3 DESCRIPTION

A. Disinfection Requirements

1. Contractor shall practice precautions to protect interiors of pipes, fittings, and valves against contamination during construction.

a. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material.

b. Close openings of pipeline when pipe laying is stopped at end of work day or for other reasons, such as rest breaks or meal periods.

2. Notify LANL Construction Inspector prior to any discharges as described in Section 1.3.B.

3. Do not disinfect any pipe until source of potable water supply used for flushing or disinfection is approved by LANL Construction Inspector.

4. After successful hydrostatic testing, flush and disinfect water mains by AWWA C651, "Disinfecting Water Mains," using “Continuous Feed Method” as described in Section 3.1.

5. Disinfect interior water piping as described in Section 3.2.

6. LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality as described in Section 1.3.D.

7. Do not place piping in service until notified by LANL Construction Inspector that water quality test results are approved by LANL, as described in Section 1.3.D.

8. Reflush and retest disinfected potable water piping, which has been allowed to stand stagnant for more than 30 days before being placed in service.

9. Disinfect piping within building with service taps and fixtures installed. Flow chlorinated water and flush water through lavatories, sinks, drinking fountains, showers, and hose bibs.

B. Water Discharge Requirements – Contractor

1. Refer to Section 01325.

2. Chlorinated water used for disinfection shall be dechlorinated prior to discharge as described in Section 3.4.

3. For discharge of chlorinated/dechlorinated water, notify LANL Construction Inspector, as described in Section 1.3.D, to arrange for a total chlorine concentration test.

C. Water Discharges Requirements – LANL Construction Inspector

1. Refer to Section 01325.

D. Water Quality Testing Requirements - Contractor

1. Notify LANL Construction Inspector at least 48 hours (2 working days) in advance to arrange for a free or total chlorine concentration test.

2. Notify LANL Construction Inspector at least 48 hours (2 working days) in advance to arrange for bacterial quality test.

3. Requirements for demonstration of compliance with the Maximum Containment Level (MCLs) of the Safe Drinking Water Act:

a. Total chlorine concentration of less than 1 mg/L (1 ppm).

b. The absence of any coliform bacteria.

c. Less than 200 noncoliform bacteria per 100 mL sample.

E. Water Quality Testing Requirements – LANL Construction Inspector

1. LANL Construction Inspector will notify the Contract Safe Drinking Water Act (SDWA) Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a total chlorine concentration test.

2. LANL Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a bacterial quality test.

3. LANL Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for monitoring batch treated discharge for pH and chlorine.

PART 2 CHEMICAL PRODUCTS

2.1 MATERIAL SAFETY DATA SHEETS

A. Maintain on site Material Safety Data Sheets (MSDS) for chemical products, including disinfection and dechlorination products.

2.2 ACCEPTABLE DISINFECTANTS

A. Sodium hypochlorite solution (bleach) contains approximately 5 percent to 15 percent available chlorine. Use care in control of conditions and length of storage to minimize its deterioration.

B. Calcium hypochlorite (HTH) granules contain approximately 65 percent available chlorine by weight. HTH will not readily dissolve in water with a temperature of less than 41 degree F. Store HTH in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase HTH into piping is not permitted.

C. Disinfection with chlorine gas or liquid is not permitted.

2.3 ACCEPTABLE NEUTRALIZING AGENTS

A. Use sodium thiosulfate (technical grade, prismatic rice) as neutralizing agent.

B. Use of sulfur dioxide gas is not permitted.

2.4 PRECAUTIONS

A. Calcium hypochlorite (HTH) is corrosive and is a strong oxidizer. Reducing agents (*e.g.* sodium thiosulfate), concentrated acids, and organic compounds (e.g. antifreeze, gasoline), can oxidize, burn or explode if they come into contact with solid phase HTH.

B. Do not use calcium hypochlorite (HTH) on solvent-welded plastic pipe or on screwed-joint steel pipe because of danger of fire or explosion from reaction of joint compounds with HTH.

PART 3 EXECUTION

3.1 DISINFECTION OF NEW WATER MAINS BY THE CONTINUOUS-FEED METHOD

A. Preliminary flushing

1. Prior to disinfection, fill main with water to eliminate air pockets.

2. Flush main to remove particles. Flushing velocity in main shall not be less than 2.5 ft/s. Flush new system until foreign matter, debris, and discolored water is cleared. The following table shows rates of flow required to produce a velocity of 2.5 ft/s in pipes of various sizes. If water is flushed to environment follow requirements in Section 01325 for notification and possible dechlorination purposes.

Nominal Pipe Size (inches.)	Flow Required To Produce 2.5 feet/s (approx.) Velocity In Main (gpm)
4	100
6	200
8	400
10	600
12	900
16	1600

3. Obtain verification from LANL Construction Inspector that system has been thoroughly cleaned (flushed) and is ready for chlorination.

B. Chlorination of the Main

1. Chlorinated water, with a free chlorine concentration of not less than 25 mg/L, shall enter main at a point no more than 10 feet downstream from beginning of new main. Contractor shall verify free chlorine concentration of not less than 25 mg/L by a primary free chlorine concentration test as described in Section 1.3.D.

2. Retain chlorinated water in main for at least 24 hours during which time valves and hydrants in system shall be operated to ensure disinfection of the appurtenances.

3. At end of 24-hour period, treated water in all portions of main shall have a free chlorine concentration of not less than 10 mg/L. Contractor shall verify free chlorine concentration of not less than 10 mg/L by a secondary free chlorine concentration test as described in Section 1.3.D.

4. After secondary free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm).

5. After final flushing, contact LANL Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

6. After final total chlorine concentration and bacteriological quality tests have been completed, LANL Construction Inspector will furnish disinfection report to Contractor. If water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D, repeat 1, 2, 3, 4, and 5 until test results demonstrate compliance.

3.2 DISINFECTION OF INTERIOR PIPING

A. Follow requirements in Section 01325 for water discharged to the environment.

B. If total quantity of chlorinated waters for disinfection is less than 100 gallons, disinfection water may be discharged directly to wastewater collection system without regard to chlorine concentration.

C. If total quantity of chlorinated water for disinfection is 100 gallons or more, disinfection water shall be dechlorinated prior to discharge as described in Section 1.3.D.

D. Chlorination of piping

1. Use chlorinated water, with free chlorine concentration of not less than 25 mg/L, for disinfection of interior piping. Verify free chlorine concentration of not less than 25 mg/L by a primary free chlorine concentration test as described in Section 1.3.D.

2. Retain chlorinated water in piping for at least 24 hours, during which time lavatories, sinks, drinking fountains, showers, and hoses bibs shall be operated to ensure disinfection of appurtenances.

3. At end of 24 hour period, treated water in all portions of piping shall have a free chlorine concentration of not less than 10 mg/L. Contractor shall verify free chlorine concentration of not less than 10 mg/L by a secondary free chlorine concentration test as described in Section 1.3.D.

3. After secondary free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in piping is less than 1 mg/L

(1 ppm).

3.3 DISINFECTION FOR REPAIR AND/OR MODIFICATION OF EXISTING MAINS OR INTERIOR PIPING SYSTEMS

A. Prior to repair and/or modification of piping systems, disinfect any tools to be used for repair and/or modification.

B. Where practical, isolate a section of affected line and shut off all service connections.

C. Flushing

1. Prior to disinfection, flush affected line to clean out contamination introduced during repairs. If possible, flush from both directions. Flush until discolored water is eliminated and water flows clear. If line segment cannot be isolated, thoroughly flush the segment through a tank or fire hydrant. If water is flushed to environment, follow requirements in Section 01325 for notification and possible dechlorination purposes.

2. Obtain verification from LANL Construction Inspector that affected line has been thoroughly cleaned (flushed) and is ready for chlorination.

D. Swab or spray inside of new pipe and fittings with a minimum of 1 percent (10,000 ppm) hypochlorite solution before they are installed.

E. Apply chlorine to water from existing supply to expose interior surfaces of affected segment at the chlorine concentration and contact times as follows; verify total chlorine concentration by an initial total chlorine concentration test as described in Section 1.3.D:

Chlorine Concentration (mg/L,ppm)	Contact Time
300	15 minutes
250	1 hour
200	1.5 hours
150	2 hours
100	3 hours

F. Retain chlorinated water in main, or piping, for above prescribed contact time. At the end of prescribed time period, flush affected line with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm).

G. After flushing, contact LANL Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

H. After final total chlorine concentration and bacteriological quality tests have been completed, LANL Construction Inspector will furnish disinfection report to Contractor. If water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D, repeat E, F, and G above until test results demonstrate compliance.

3.4 DECHLORINATION OF DISCHARGES

A. Sodium thiosulfate crystals may be applied manually or a liquid solution of sodium thiosulfate may be directly injected into chlorinated water discharge pipe using a metering pump or venturi injector.

B. Provide mixing tank to allow dechlorination of water prior to discharge.

C. Approximate dosage rate of sodium thiosulfate may be calculated from the following table:

Free Chlorine Residual Concentration	Sodium Thiosulfate
10 mg/L	1.2 lb/10,000 gal
50 mg/L	6.0 lb/10,000 gal
500 mg/L	60.0 lb/10,000 gal

D. Do not dose sodium thiosulfate beyond the minimum required to neutralize the chlorine actually present in discharge.

END OF SECTION